

WASHINGTON

SCIENCE TRENDS

HIGHLIGHTS

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New Ceramic Properties

The National Bureau of Standards has discovered a ceramic that has both ferroelectric and ferrimagnetic properties to an appreciable extent. Researchers believe that the composition should find many applications in new electronic components.

***Background:** The Bureau points out that although ceramics with magnetic properties have been known for some time, none -- until now -- have been known to show both ferroelectric and magnetic properties at the same time. No theory exists on whether or not there could be such a material.

***Findings:** Nearly 90 dielectric compositions were examined and tested before finding one with both of the sought-after properties. The generalized composition is a barium niobate containing a rare earth plus iron oxide, and has a single phase crystalline structure. Compositions were made successfully with the rare earths neodymium, samarium, europium or gadolinium, and with varying amounts of iron.

***Significance:** The Bureau points out that ordinarily, ferroelectrics have high dielectric permittivity and very small magnetic permeability while ferrimagnetics have high magnetic permeability and very small dielectric permittivity. Since the two properties seem to be mutually dependent in these materials the Bureau believes the composition should find application in new electric components where a coupling between dielectric and magnetic effects is desirable, or where a magnetic material having a high dielectric constant would be useful.

(R&D by P.H. Fang and R.S. Roth, Mineral Products Laboratory, National Bureau of Standards, Washington 25, D.C.)

Missile and Space Programs: An indication of the scope of the nation's space planning programs may be seen in reliable reports that ultimate production of the huge Saturn boosters is envisioned by the National Aeronautics and Space Administration at about four per year. Reports are also circulating in Washington of possible increased output for the Army's Redstone program. The missile is expected to be used by Allied forces overseas and as a supply missile for advanced Army forces in the field, in addition to its normal tactical missions.

Loran C Tests

A low-frequency system designated Loran-C has been tested by the Navy with results said to be favorable. A final report to the Navy by the firm of Jansky and Bailey, Washington, D.C. recommends that such systems be installed in a number of areas throughout the world for accurate positioning. The report also recommends that its use be encouraged as a universal long-range electronics navigation system for general-purposes.

Studies were made using equipment modified by the Sperry Gyroscope Co. at stations in Massachusetts, North Carolina and Florida. The system was found to provide a greater range than conventional Loran, and a more precise method of position fixing, in addition to other advantages.

Omega VLF Navigation System

Navy hopes to conduct a thorough evaluation by next year of its Omega system which is expected to provide long-range navigation coverage with improved accuracy using a sharply reduced number of stations.

System: Omega is described by the Bureau of Ships as a hyperbolic system operating in the 10-14 kilocycle band now assigned for navigation. Lines of position are determined by measuring phase difference of the carrier frequency. A group of stations operate on the same carrier frequency and are keyed on and off sequentially.

Progress: Tests have been conducted between San Diego and Hawaii, San Diego and Washington and other paths. A 100 watt transmitter at Honolulu was used in early tests, but a 1,000 watt transmitter is now available. A second transmitter has been installed at Forestport, N.Y., and this pair has been in operation for about one month. The Navy hopes to establish a third station in the Canal Zone in the coming months, preparatory to a full-scale evaluation in 1961.

Advantages: Navy researchers believe that it will be no problem to synchronize carrier frequencies for operation over a 5,000 mile baseline, providing worldwide coverage with 8 to 10 stations capable of providing a position fix accuracy of plus or minus one mile, day or night. Some 57 Loran stations now cover only ten percent of the earth, according to the Navy, with an accuracy of plus or minus two miles, during daytime.

Powers in the order of 2 to 5 kilowatts radiated should be adequate for these stations, according to estimates. Cost of such stations is estimated at \$5 million each, with low maintenance and upkeep costs.

Advocates of the system describe it as providing the potential for the "simplest airborne equipment yet devised" for hyperbolic navigation. Front-end design for an airborne receiver is said to be simple, stations are expected to be easily recognized, circuits are said to be simple and reliable and no special circuits are needed for protection against ground wave or skywave interference. Instrumentation for display and related purposes is also said to be simplified.

(R&D by Radar Branch, Bureau of Ships, U.S. Navy, Washington 25, D.C. and Naval Electronic Laboratory, San Diego, Calif.)

Depleted Uranium Studies

U.S. Bureau of Mines and the Atomic Energy Commission are sponsoring studies aimed at finding potential uses for mounting supplies of uranium hexafluoride, or uranium from which most of the fissionable component has been removed. Several thousand tons could probably be made available each year.

Here is an official summary of current R&D. Individuals interested in further details may arrange to visit the laboratories concerned:

*Rolla (Mo.) Metallurgy Research Center: Efforts here are being made to evaluate the possibility of blending depleted uranium metal with lead, tin, or copper to produce a superior combination for metal bearings.

Tests are also being conducted to determine whether so-called sacrificial anodes of depleted uranium will prove more effective than conventional zinc or magnesium in retarding corrosion of pipelines, ship hulls and similar objects.

*Boulder City (Nev.) Metallurgy Research Center: Research is being conducted to find a specialty application in recovering high value minerals. Uranium has a higher density than the ferro-silicon and magnetite commonly used in separation slurries.

*Albany (Ore.) Metallurgy Research Center: Emphasis here is on the possibility that uranium can impart exceptionally high tensile strength to steel, for applications in aircraft and other fields. Related work is also being carried out at Rolla.

*Laramie (Wyo.) Petroleum Research Center: Here uranium oxide is being tested as a catalyst in laboratory-scale oil refining. Experiments are said to indicate definite promise for such applications although further studies are necessary.

Automatic Mail Sorting

National Bureau of Standards is developing new statistical techniques for estimating the feasibility of automatic mail sorting by the Post Office Department. Both flow patterns and physical characteristics of mail passing through large city post offices are being analyzed.

*Mail Flow: A "chain ratio" sampling plan was successfully used in estimating the distribution of mail by destination. The conclusions reached on outgoing mail from the cities tested indicates that a single type of automatic sorting machine can be used in large post offices throughout the U.S., without extensive modification to allow for local peculiarities. (The Bureau believes that the methods introduced in this study can be applied to other situations in which sampling techniques can replace complete enumeration.)

*Sorting Schemes: Several configurations were studied. In the so-called "Christmas Tree" scheme some 1600 destinations were divided into 40 groups of 40. Mail is first sorted by group, and then mail in each group is sorted by destination. Cost on this scheme was found to exceed the minimum by 50 percent or more. A so-called simple residue scheme, categorizing each destination as "frequent" or "infrequent" was found to be preferable, particularly when a third "intermediate" category was included.

Project Walrus - Maritime R&D

Extensive research and development in the maritime field has been recommended by the participants in Project Walrus, a summer-study group sponsored by the U.S. Government to appraise the state of the U.S. Merchant Marine.

Here are some major findings and recommendations which point the way to possible future programs:

- * U.S. Maritime Administration is urged to give serious consideration to establishment of a new comprehensive research center to further both technical and operational research. At the present time, the Committee points out, most commercial testing work is sent to European tanks by U.S. designers.
- * More work should be done on unitized cargo concepts and on possible automated handling into and out of the ship with an objective of faster handling and reduced manpower costs.
- * Studies should be made of the practicability of automated control of ships, and propelling or other machinery.
- * There should be operating-cost studies of the commercial feasibility of high-speed express cargo service on certain routes at premium rates.
- * Design and construction of an aluminum cargo ship should be carried out to determine the design, structural and construction problems involved.
- * Maritime interests should work closely with the military on uses for roll-on, roll-off ships, a small 20-knot vessel capable of discharging rapidly in small harbors and/or onto beaches, submarine tankers and submersible barges and on possible anti-submarine features for commercial vessels.

(Further details available. Single copies free. Write Printing and Publishing Office, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington 25, D.C. for Project Walrus - NAS Pub. 748)

Western Radioisotopes Conference

Atomic Energy Commission and local educational institutions will co-sponsor a three-day conference on the industrial applications of radioisotopes at the University of California Extension Center, San Francisco Feb. 3 to 5. Industry and Commission spokesman will present program details and experience reports.

(Management and Technical Personnel and educators wishing to attend the meeting may obtain additional information from the Department of Conferences, University of California Extension, 2451 Bancroft Way, Berkeley, Calif.)

Research Checklist

- () Titanium Castings: Studies at the U.S. Army's Watertown Arsenal indicate that titanium alloy scrap can be reprocessed by induction melting to produce castings with mechanical properties almost reaching the specification for forged castings. Process is said to be efficient and economical.
- (Report available. 17 pages. 50 cents. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 572)
- () Helicopter Stabilizing System: The U.S. Navy is testing a new system for stabilizing light helicopters which is said to greatly reduce the effort required by pilots in operations where precise control is necessary. The nine-pound system uses rate gyroscopes, with miniaturization accomplished through the use of printed circuits, de-rated components, silicon transistors and diodes. Shock mounts are eliminated by mounting an amplifier directly on the airframe. Control system push rods are replaced by actuators, which can be installed in a wide variety of helicopters.
- (R&D by Autonetics Division, North American Aviation, using specifications by the Airborne Instruments Laboratory, U.S. Navy, Johnsville, Pa.)
- () Liquid Metal Pump: Studies sponsored by the National Aeronautics and Space Administration are designed to determine the processes which cause erosion and cavitation in the pumping of liquid metals, such as those planned for possible power generation in future space vehicles. Cavitation is said to result in a local "boiling" in which cavities or "bubbles" enter a pump's high pressure region and subsequently collapse in a violent reaction which can break down the strongest materials. When liquid metals are used a chemical reaction accompanying cavitation accelerates this process.
- (R&D by Prof. F.G. Hammitt, Mechanical and Nuclear Engineering Departments, University of Michigan, Ann Arbor, Mich.)
- () Crystal Growing Furnace: Hoffman Electronics Corp. has developed a new semiautomatic furnace which is said to triple the production of monocrystalline silicon by growing ingots three times larger than conventional furnaces in the same period of time. A novel resistance heating system is said to heat and melt larger masses of silicon with less power and with superior temperature control.
- () Electronic Rivet Head Inspection: Greatly increased accuracy and reduced inspection time are said to be major advantages of a new device developed for inspection sampling of rivet heads. The unit is said to be capable of measuring individually a batch of 50 rivets which are then automatically averaged and computed so as to govern acceptance or rejection for some 332 categories of rivets which must meet extremely close tolerances. The device consists of an electromechanical transducer, balancing circuits, oscillator, amplifier, computer and power supply.
- (R&D by Electrodynamics staff, Transport Division, Boeing Airplane Co., Seattle 24, Wash.)

Publication Checklist

- () National Science Foundation, the annual report of the major government agency in the field of research support. Summarizes activities and programs and lists grants and institutes. 274 pages. \$1. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for NSF 60-1)
- () Air Force Procurement, a highly critical Air Force report taking the Air Force to task for its "virtual reliance since 1944 on only one source of supply for altimeters." Single copies free. (Write Subcommittee on Government Procurement, Small Business Committee, U.S. Senate, Washington 25, D.C. for Report - Altimeter Procurement)
- () Soviet Space Technology, a transcript of hearings conducted in May, 1959 and now available relating to a published report that the Soviet "Lunik" was a hoax. 210 pages. Single copies free. (Write Committee on Science and Astronautics, U.S. House of Representatives, George Washington Inn, Washington 25, D.C. for Hearings No. 46)
- () Science Information Research, the latest in a series of reports on Patent Office attempts to mechanize retrieval of science and patent information. This report deals with a procedure for analyzing and encoding documents, particularly in the chemical field. 32 pages. 25 cents. (Write Publications Desk, U. S. Department of Commerce, Washington 25, D.C. for Patent R&D Report No. 17)
- () Metal Fatigue, a list of 386 references to articles published during 1958 dealing with the fatigue of structures and materials. 76 pages. \$3.50. (Write Publication Department, American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., for STP 9-J)
- () Soviet Celestial Mechanics Literature, a U.S. Government translation containing a bibliography of 850 references on celestial mechanics; 375 are discussed in some detail. 261 pages. \$4. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Pub. 59-11936)
- () Women and Science, a new Labor Department bulletin discussing careers for women in chemistry, physics, geology, astronomy and meteorology. Stresses the importance of educational preparation and abilities and aptitudes. 35 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for "Careers for Women in the Physical Sciences.")
- () Tungsten-Molybdenum Separation, a report on fused-salt-bath electrolysis, said to be a new and simpler method for selectively extracting tungsten and molybdenum from domestic mineral concentrates. Single copies free. (Write Publications-Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa., for Report of Investigation 5554)
- () Engineering College Research, an excellent guide to research projects and administrators at colleges and universities. 445 pages. \$2. (Write W. Leighton Collins, ASEE, University of Illinois, Urbana, Ill., for Research Review, 1959)

